

# 16<sup>th</sup> Quarterly Report – Public Page

**Date of Report:** September 30, 2011

**Contract Number:** DTPH56-07-T-000010

**Prepared for:** U.S. DOT/PHMSA and OTD

**Project Title:** Butt Fusion Integrity & Evaluation of NDE Technologies – Phase II

**Prepared by:** NYSEARCH/Northeast Gas Association

**Contact Information:** Joseph P Mallia (973) 265-1900 Ext. 209  
Email - [jmallia@northeastgas.org](mailto:jmallia@northeastgas.org)

**For quarterly period ending:** September 30, 2011

## Public Page Section

### Activities/Deliverables Completed:

<u>Task #</u>	<u>Description</u>	<u>Schedule date</u>	<u>Complete date</u>
88-1	Facilitate joint industry steering committee interactions to establish project boundaries, monitor analytical modeling and comprehensive testing, provide objective review of resulting data development, and establish consensus based recommendations.	06/01/11	09/30/11
89-3	Review of technical data from empirical testing and analytical modeling to establish testing protocols for larger diameter pipe testing	06/01/11	09/30/10
90-3	Fabricate test specimens and initiate and/or continued whole pipe creep rupture testing on actual fused specimens based on the DOE single run experiment	06/01/11	09/30/10
91-6	Status Report	09/15/11	09/30/11

### General Information

The point of contact for coordination, preparation, and distribution of any press releases is per NYSEARCH, Joseph P Mallia.

The objective of the overall program is to evaluate the butt fusion process for polyethylene (PE) piping systems and investigate the detection capability of various NDE technologies available in the marketplace based on a range of fusion parameters. The evaluation process includes applying existing empirical tests and developing new test approaches to determine butt fusion joint integrity and safe long

term performance for butt fusion joints. A range of butt fusion variables were considered including heat-iron temperature, pressure, time and ambient temperature. The Phase II program extends the results of the initial phase by performing comprehensive long term performance tests and to include evaluation of larger diameter PE piping systems. These results can be used as the basis for process improvements and continued technology developments; and integration of new test methods and fusion parameters within applicable industry standards and specifications (ASTM, PPI, 49CFR Part 192).

The program also considered the integrity of butt fusion joints under the influence of anticipated in-service conditions such as bending, internal pressure and soil loading. By leveraging the results of these parametric tests, a variety of NDE technologies (UltraMac, Digital X-ray, Microwave and ultrasonic phased array) continue to be evaluated to determine their current capability of discerning "good" versus potentially "suspect" joints. This is intended to establish a reference baseline as a function of process variables for the continued development of NDE technologies.

### **Results and Conclusions:**

Based on Phase I program, the Whole Pipe Creep Rupture test results show that this approach appears to be a viable solution in assessing joint integrity and is discriminating enough to evaluate the range of fusion parameters selected. For the first time, a test method can be applied to differentiate the joint integrity or "good" versus "poor" quality joints. Standard destructive tests performed by others and within the scope of this program have shown that short term tensile samples, Rate Process Method and sustained pressure testing are not acceptable methods for discerning variations in joint parameters and are better suited for pipe/joints with critical flaws or defects.

In general, while the cumulative results shows significant advancement in the overall understanding of PE heat fusion joining, it is important to note and emphasize that they are considered to be preliminary at this time. Program findings and results need to be further validated, therefore additional work and testing was approved for continuing the program. Phase I concluded that additional series of data points need to be considered in order to further validate the findings. In addition, additional work needs to be performed to include larger diameter pipe sizes.

### **Plans for Future Activity:**

The extended program involves continuing the analytical modeling and testing efforts to include additional 2" butt fusion joints and larger diameter sizes (8-inch or 12-inch). This will require more sophisticated modeling techniques and Design of Experiments (DOE) protocols to correlate the statistical significance for the interactions between the various process parameters. Specifically, by further refining the analytical models, the two way interactions among the various process parameters will be quantified and statistically significant relationships can be developed. The WPRC testing will be extended to larger diameter pipe sizes and additional tests will be performed on the 2-inch butt fusions joint specimens to further validate the applied modeling/testing methods.